CHAPTER 15

Iran

Nuclear Weapons Capability

Iran does not possess nuclear weapons, but for more than two decades Tehran has secretly pursued the ability to produce nuclear materials that can be used in weapons. U.S. officials and intelligence services in several other nations have concluded that Iran is embarked on a nuclear weapon program, although no direct evidence of weapon activities has been made public.[1] Iran remains a party to the Non-Proliferation Treaty (NPT). Despite Iran's membership in the International Atomic Energy Agency (IAEA), that agency's Secretariat concluded in November 2004 that Iran had "failed . . . to meet its obligations under its safeguards agreement." Efforts to sanction Iran for its "failures" have been put on hold while members of the European Union attempt to negotiate an end to Iran's nuclear fuel production programs.

Past estimates about when Iran might be able to produce a nuclear weapon have proven unreliable. For example, a 1992 Central Intelligence Agency (CIA) estimate concluded that Iran would have the bomb by 2000.[2] If Iran's nuclear activities continued without outside constraint and without significant outside assistance, it could take several years for Iran to build and operate a fully functioning uranium enrichment "cascade" and an additional one to two years for that facility to produce enough weapons-grade material for the country's first nuclear device.

Missile Capability

Iran possesses up to 300 Scud-B missiles with a 300-kilometer range and with a payload of 1,000 kilograms, and perhaps 100 Scud-Cs with an approximate range of 500 kilometers with a 1,000-kilogram payload.[3] Iran has also received enough assistance from North Korea to enable the country to produce its own Scud missiles.[4]

Iran has conducted at least ten tests of the medium-range Shahab III. The system is derived from the North Korean No Dong missile, with a range of 1,300 kilometers and a payload of about 750 kilograms. The first flight test was carried out on July 22, 1998, and more recently it was tested on October 20, 2004.[5] Former Iranian president Akbar Hashemi Rafsanjani claimed on October 5, 2004, that Iran possessed a missile with a range of 2,000 kilometers, but he provided no evidence to support this claim.[6]

Both Iranian and foreign officials often claim greater progress for Tehran's missile program than tests seem to indicate. Some Western intelligence officials believe that the Shahab III, in an August 2004 test, traveled only 100 kilometers before crashing to the ground.[7]

The Shahab III has a sufficient range and payload to deliver a nuclear warhead as far as Israel and parts of southern Europe. It is not known, however, if Iran possesses the technology needed to miniaturize a nuclear warhead to deliver it by missile. Iran has built and publicly displayed prototypes of the missile, and a limited number reportedly have been deployed with units of Iran's elite Revolutionary Guard.[8] For several years, U.S. officials have assessed that Tehran could have the Shahab III on "emergency operational status."[9] In November 2004, Iranian defense minister Ali Shamkhani claimed that Iran was capable of mass producing Shahab III missiles, although this claim has not been confirmed.[10]

Iran allegedly bought six KH-55 cruise missiles from Ukraine in 2000. These Soviet-era missiles are designed to carry a 200-kiloton nuclear warhead on Russian-made Tupolev long-range bombers.[11] Iran does not possess such bombers, but it may be able to adapt its Soviet-built Su-24 strike aircraft to carry the KH-55.[12]

Biological and Chemical Weapons Capability

Although Iran is a member of the Biological Weapons Convention, U.S. intelligence reports from 2003 claim that Iran probably maintains an "offensive biological weapon program," with the capability to produce small quantities of biological weapon (BW) agents but limited ability to weaponize them. There is no independent confirmation of these claims.

In May 1998, after acceding to the Chemical Weapons Convention, Tehran acknowledged its previous chemical weapon (CW) development and production. The Iranian CW program began in the 1980s during the war with Iraq, and Iranian officials say that the program was dismantled at the war's end. The CIA, however, claims that Iran continues to seek production technology, training, and expertise from Chinese entities that could further Tehran's efforts to achieve an indigenous capability to produce chemical nerve agents. The CIA believes that Iran likely possesses both a stockpile of blister, blood, choking, and probably nerve agents and also the bombs and artillery shells to deliver them, which it had previously manufactured.[13] There is no independent confirmation of these claims.

The Strategic Context

A Persian power with a keen sense of history, Iran occupies a pivotal position straddling the Caspian Sea and the Persian Gulf, a vital maritime pathway for crude oil transport. Iran has the largest population in the Middle East and the world's third largest oil reserves and second largest natural gas reserves, and it aspires to again become the region's major power, commensurate with its history, geography, and resources. Some Iranian leaders have come to see the possession of unconventional weapons, including nuclear weapons and ballistic and

cruise missiles, as critical parts of their national security and domestic political strategies.

Since the removal of Saddam Hussein from power in Iraq, Iran has likely seen unconventional weapons as a deterrent to possible U.S. military action—particularly given the large U.S. military presence in the region—and as a way to increase Tehran's power and prestige in the Persian Gulf. Iranian officials have also apparently been influenced by Israel's, India's, and Pakistan's advanced nuclear capabilities; North Korea's ability to deter U.S. coercion with its nuclear capabilities; and Israel's growing ties with Turkey to the north and India to the east. In addition, military officials in Iran may see nuclear weapons as a way to compensate for the gap between Iran's conventional military, constrained by U.S. sanctions, as compared with Gulf Arab states, which spend vast amounts of money on state-of-the-art, high-technology weaponry—often supplied by the United States.[14]

In recent years, the pursuit of civilian nuclear capabilities has become a potent domestic issue in Iran. Indeed, both conservatives and reformers support Iran's development of its nuclear fuel cycle capabilities as an inherent right accorded by the NPT. In October 2004, the parliament voted unanimously to resume uranium enrichment after a temporary suspension;[15] and in November of that year, hundreds of university students gathered outside the Atomic Energy Organization demanding that the government not concede Iran's right to peaceful nuclear technology.[16] Iran's pursuit of nuclear capabilities is seen as a source of national pride across the political spectrum, a situation that may greatly complicate efforts to convince Iranian officials to end the pursuit of their country's sensitive nuclear fuel cycle programs.

Ostensibly, Iran's nuclear program is peaceful. However, the country hid sensitive nuclear activities from the IAEA and the world for more than eighteen years, having acquired advanced uranium enrichment equipment and expertise through the nuclear black market of Pakistan's A. Q. Khan. The discovery of these clandestine activities has contributed to international suspicion about Iran's program. The successful acquisition by Iran of a fissile material production capability or of actual nuclear weapons would be a serious blow to global nonproliferation efforts. If the international community is unable or unwilling to impose penalties on Iran, and if Tehran succeeds in continuing its nuclear development, many states will question the strength and utility of the nonproliferation system. Moreover, there is serious concern that a nuclear-armed Iran would lead other states in the Gulf and Middle East to reexamine their nuclear options, including possibly Saudi Arabia, Egypt, Syria, and even Turkey, a NATO member and European Union applicant.[17] This potential wave of proliferation would seriously challenge regional and global security and undermine the worldwide effort to prevent the spread of nuclear weapons.

Iran's Nuclear History

In 1951, the democratically elected prime minister of Iran, Mohammad Mossadeq, nationalized the country's oil assets. The leaders of the United States

and the United Kingdom concluded that his policies meant "that Iran was in real danger of falling behind the Iron Curtain" resulting in "a victory for the Soviets in the Cold War and a major setback for the West in the Middle East."[18] Declassified documents show that in 1953 President Dwight D. Eisenhower approved a joint British-American operation to overthrow Mossadeq, code named Operation Ajax. The CIA successfully toppled the young democratic government and installed Mohammad Raza Shah Pehlavi as the new pro-West ruler, sowing the seeds of Iran's lingering distrust of Western powers.[19]

Under the shah's autocratic rule, relations between the United States and Iran thrived. During this period, Iran began its nuclear power program, which then progressed slowly until the late 1960s. Also during this period, Iran acquired its first nuclear research reactor, a small U.S.-supplied 5-megawatt-thermal (MWt) reactor that is still in operation at the Tehran Nuclear Research Center.[20] During the 1970s, Iran developed plans to build 22 nuclear power reactors with an electrical output of 23 gigawatts. These nuclear activities were halted when the shah was toppled in 1979 and the Islamic regime led by Ayatollah Ruholla Khomeini came to power. The new revolutionary government inherited two partially completed West German–supplied nuclear power reactors at Bushehr, but Khomeini froze construction of these reactors and all other work on "Western" nuclear technologies and forced many Western-educated scientists and engineers to flee the country.[21]

Iraq's use of chemical weapons during the Iran-Iraq War in the 1980s drove Iran's more recent pursuit of nuclear technologies, chemical weapons, missile systems, and possibly biological weapons. Iranians often point out that no nation came to Iran's aid when it was invaded and attacked by Iraq with chemical weapons. U.S. relations with Iraq actually improved during this period, as U.S. officials aided the secular Saddam as a counter to what was seen as the greater threat of Iran's militant Islamic theocracy. The regime in Tehran appears to have then decided to pursue unconventional weapons as an important means of deterrence and self-defense.

Shortly after the Iran-Iraq cease-fire, Akbar Hashemi-Rafsanjani, then–speaker of the Iranian parliament and commander-in-chief of Iran's armed forces and later Iran's president, declared:

> With regard to chemical, bacteriological, and radiological weapons training, it was made very clear during the war that these weapons are very decisive. It was also made clear that the moral teachings of the world are not very effective when war reaches a serious stage and the world does not respect its own resolutions and closes its eyes to the violations and all the aggressions which are committed in the battlefield. We should fully equip ourselves both in the offensive and defensive use of chemical, bacteriological, and radiological weapons. From now on you should make use of the opportunity and perform this task.[22]

The missile programs have continued until the present day; it is unclear if other programs have as well. Iran has relied extensively on outside assistance for the acquisition of its unconventional weapons capabilities, including direct assistance from the A. Q. Khan black market network, China, North Korea, and Ukraine, and indirect assistance from Russia and countries in Europe.

Nuclear Analysis

As of the spring of 2005, there was no evidence that Iran possesses enough fissile material to produce nuclear weapons or possessed any nuclear devices.[23] Yet for the past two decades, Iran has been engaged in a secret, multifaceted program to produce nuclear materials. This has created widespread concern that Iranian leaders are committed to acquiring the means to produce nuclear weapons, if not actual weapons. In addition, there have been reports, some more reliable than others, that Iranian agents have sought to acquire nuclear materials and even weapons from other countries, including stocks of plutonium and highly enriched uranium left in Kazakhstan after the fall of the Soviet Union.

In 2002, an Iranian opposition group revealed that the country's nuclear program was much more extensive and alarming than Tehran had previously declared, or than of which the IAEA was aware (see table 15.1 at the end of the chapter). After almost two years of intensive investigations, the IAEA reported in November 2004 that it was still not "in a position to conclude that there are no undeclared nuclear materials or activities in Iran."[24] It is now known that Iran's activities include the pursuit of several nuclear material production technologies that, if mastered, could provide Tehran with the ability to produce the core materials for nuclear weapons. Iran maintains that all its nuclear activities, even those previously hidden from the IAEA, are intended for peaceful purposes; and it has agreed to place all its nuclear activities under IAEA safeguards. Moreover, in 2003 Iran signed and pledged to implement the IAEA's Additional Protocol, which includes expanded inspection rights and tools.

Uranium Enrichment

Iran has pursued at least two different methods for enriching uranium: gas centrifuges and lasers. Work on the gas-centrifuge enrichment program appears to have begun in 1985, while the laser enrichment program began under the shah in the 1970s. Work on Iran's uranium centrifuge was greatly accelerated in the 1990s after Iran gained access to centrifuge technology and material through the A. Q. Khan network, although exactly when these contacts were made remains unclear. Iran had previously tried to purchase a centrifuge facility from Russia in the 1990s, a deal that died after the United States complained to Moscow about the potential proliferation implications of such a facility.

CENTRIFUGE PROGRAM. Iran's uranium enrichment program involves the acquisition, testing, and production of two types of centrifuges, known as the P-1 and the more efficient P-2 designs (the "P" stands for the Pakistani origins of the design). All of Iran's known installed and production capabilities rely on the P-1 design, although in January 2004 Iran acknowledged that it had received advanced P-2 centrifuge drawings from foreign sources in 1995. Iran maintains that no P-2 centrifuges or components were obtained from abroad and that all P-2 components in its possession were produced domestically. Tehran claims

that information about the P-2 program had not been included in previous declarations (which it had characterized as correct and complete, including its October 2003 declarations to the IAEA) due to "time constraints."

Iran has a complete pilot-scale centrifuge facility and a larger, as yet incomplete, industrial-scale centrifuge facility, both located at Natanz, approximately 200 miles south of Tehran. The site contains buildings both above and below ground and covers approximately 100,000 square meters. In August 2002, the National Council of Resistance of Iran, an opposition group based in France, publicly disclosed the existence of the site, which had previously been unknown and undeclared to the IAEA. After the disclosure, the IAEA conducted its first visit to the site in February 2003, and it has since inspected numerous times and taken more than 300 environmental samples at this and related sites.

Iran had planned to eventually install up to 1,000 P-1 centrifuges at the pilot enrichment plant. When operations were suspended in November 2004, the site contained 164 centrifuges. Between March and May 2003, the IAEA took environmental samples before uranium was officially introduced at the facility. These samples revealed particles of highly enriched uranium, the production of which Iran had previously denied. Under Iran's safeguards obligations, it is required to declare all facilities to the IAEA 180 days before the introduction of nuclear materials to the facility. Though officials in several countries, especially in the United States, thought contamination indicated that Iran was working on fissile material for nuclear weapons, Iranian officials attributed the sample results to the contamination of imported centrifuge components, which were believed to have come from Pakistan. Iran had earlier denied importing any centrifuge components, but when confronted with the evidence changed its story. The IAEA's November 2004 report concluded that this explanation appears plausible, although the IAEA had not yet been granted sufficient cooperation by Pakistan to fully confirm its findings.

In June 2003, Iran officially introduced uranium hexafluoride (UF_6) into a single centrifuge at the pilot plant for testing purposes. On August 19, 2003, Iran began testing a small, ten-machine cascade with UF_6 gas. In October 2003, Iran was finalizing installation of a test 164-machine cascade at the site, but it shut the cascade down that month as part of its agreement with the European Union. Iran does not appear either to have mastered the techniques needed to reliably operate the cascade or to have restarted tests during 2004.[25] Officials from several nations believe that Iran's attempt to produce uranium hexafluoride in November 2004 failed to produce a gas of sufficient quality that could be used in centrifuge enrichment.[26] Further cascade operations are precluded by the November 2004 suspension negotiated with the European Union and monitored by the IAEA. Centrifuge work had not restarted as of the spring of 2005.

The industrial-scale plant, which consists of three underground structures, was originally scheduled to start accepting P-1 centrifuges in 2005. The two largest buildings would house cascade halls large enough to contain approximately 50,000 centrifuge machines.[27] No centrifuges had been installed at the site when the November 2004 suspension was implemented.

Most of the known research and development of Iran's enrichment program has taken place at the Kalaye Electric Company facility. Iran initially denied, but subsequently admitted in 2003, that a small number of gas centrifuges was tested with uranium gas at the site between 1998 and 2002. These experiments reportedly involved 1.9 kilograms of UF_6. Iran claims that it did not enrich uranium beyond 1.2 percent uranium-235 (U-235).

Iran has also developed and built the full suite of supporting capabilities needed to pursue a uranium enrichment capability, including uranium mining, milling, and conversion. It is not clear that Iran's uranium reserves are sufficient, however, to provide enough material to fuel the Bushehr reactors or additional reactors, raising further questions about the peaceful nature of Iran's nuclear activities. If, as Iran claims, its goal in pursuing uranium enrichment is to become more independent of foreign supplies of fuel, then it would also need to possess a reliable domestic source of uranium. Without a large supply of indigenous uranium ore, it is difficult to justify the fuel cycle program it is pursuing on commercial or self-sufficiency grounds.

LASER ENRICHMENT. Iran's laser enrichment program, which began in the 1970s, is based on two techniques: atomic vapor laser isotope separation (AVLIS) and molecular isotope separation (MLIS). The IAEA has completed its review of the AVLIS program and has concluded that the levels of enrichment achieved matched Iran's description of the activity, that is, up to 15 percent U-235 enrichment. The IAEA did, however, determine that the equipment could have been used for the production of highly enriched uranium.[28] Iran established a pilot laser enrichment plant at a site known as Lashkar Ab'ad in 2000. Laser enrichment experiments at the site between October 2002 and January 2003 used 22 kilograms of natural uranium metal and produced small amounts (milligrams) of reactor-grade enriched uranium (3–4 percent U-235). This uranium metal was part of a 50-kilogram shipment that was undeclared and is suspected to have come from the Soviet Union in 1993. Iranian authorities claim that all equipment at Lashkar Ab'ad was dismantled in May 2003 and transferred to a storage facility at Karaj. The IAEA analyzed the environmental samples and found enrichment levels consistent with those declared by Iran.

Plutonium Facilities

Iran has also been engaged in efforts to test and develop the means to produce and separate plutonium, which can be used for both nuclear reactors and weapons. These activities were less advanced than the uranium enrichment effort at the time Iran suspended its nuclear activities in November 2004. Iran admits that it produced a small amount of plutonium outside of safeguards, a violation of its IAEA commitments. This production took place at the U.S.-supplied Tehran Research Reactor between 1988 and 1998 when Iran irradiated depleted uranium dioxide (UO_2) targets using materials previously exempted from safeguards in 1978 and later declared lost as waste. These experiments involved 7 kilograms

of pressed UO_2 pellets prepared at the Isfahan Nuclear Technology Center, 3 kilograms of which were subsequently reprocessed, yielding approximately 100 milligrams of plutonium. This amount is far less than would be needed to produce a nuclear weapon but enough to validate the production and separation processes.

Iran has also been pursuing the construction of a plutonium production reactor since the 1980s. It plans to build a 40-MWt heavy-water reactor at Arak that could go into operation by 2014. The plans for the reactor were completed in 2002 and would rely on the use of natural uranium oxide as fuel. Iran has also built a heavy-water production plant at Arak and had hoped to start producing heavy water there in 2004. This project was not covered by the suspension agreement with the European Union in 2004, and work at the site is thought to be ongoing.

During the course of the 1990s, the bulk of Iran's known nuclear activities focused on the Bushehr reactor program, which was in the process of being completed by Russia. The former West Germany began construction of the facility under the shah's regime. Bonn, however, first refused to complete the project after the Iranian revolution, and then refused to repair the damaged facility after the Iran-Iraq War. In 1995, Iran signed an $800 million deal with Moscow to finish the construction of one of the reactors based on a Russian-designed reactor and to house it in the German-designed reactor facility. After years of delay, on October 14, 2004, Russia announced that the construction of the 1,000-MW reactor was complete. The facility could open in 2005 and reach full capacity by 2006. However, as a condition of supply, Russia has insisted that fuel for the facility should be provided by Russia and that spent fuel should be returned to Russia for disposal. In February 2005, Moscow and Tehran signed contracts that finalized these spent-fuel arrangements.

Sources of Technology

Despite constant claims to the contrary, almost all Iran's critical nuclear materials, equipment, and technology have been acquired from foreign suppliers. The same is true for its missile capabilities, although it has now acquired the ability to produce its own Scud-type missiles. During the past 25 years, Iran has been actively engaged in acquiring a variety of sensitive nuclear capabilities, but until recently it has been unable to effectively use much of what it has acquired. Poor management, the impact of sanctions, and a less than fully developed industrial and education base may partly explain why most estimates of when Iran might be able to acquire a nuclear capability have proven incorrect. It is also possible that Iranian leaders were ambivalent about pursuing a nuclear weapons capability, that it was not a policy priority, and therefore the leaders did not muster the necessary economic and scientific resources to accelerate the program.

It is now clear that Iran has engaged in a long-term, multifaceted program to acquire nuclear and related technology and equipment from a variety of sources and that it has benefited from the A. Q. Khan nuclear black market and from poor export controls across the globe, including Europe.

Nuclear Black Market

In 1984, in the midst of the Iran-Iraq War, Iran opened a nuclear research center in Isfahan. By 1992, press reports of Western intelligence findings indicated that Iran had established experimental programs in fissile material production at Sharif University in Tehran and possibly at other locations. Iran appears to have supported these efforts through an active but clandestine procurement network, using front companies and false end-user certificates to persuade Western European companies to provide nuclear-related, dual-use technologies. Iran also purchased a number of small companies (particularly in Germany) to serve as platforms for exporting sensitive equipment to Iran.[29]

In the spring of 1995, some details emerged on Iran's nuclear procurement activities, substantiating suspected efforts to establish a secret gas-centrifuge uranium enrichment program. Specifically, Western intelligence sources were quoted as stating that, since 1990, Iran had approached German and Swiss firms to purchase balancing machines and diagnostic and monitoring equipment—all dual-use items potentially valuable for laboratory-scale centrifuge development. In addition, Iranian agents were said to have contacted a British company to obtain samarium-cobalt magnetic equipment, potentially useful in the development of centrifuge top bearings.[30]

In January 2004, the details of Iran's successful procurement of enrichment technology and nuclear know-how from A. Q. Khan and his international nuclear black market became public.[31] This network provided Iran with key centrifuge technology and is thought to have provided Iran with a list of suppliers for essential equipment (see the fuller discussion in chapter 12 on Pakistan).

China

For a decade starting in the mid-1980s, China was a source of significant assistance to Iran's civilian nuclear program.[32] Under a ten-year agreement for cooperation signed in 1990, China reportedly trained Iranian nuclear technicians and engineers in China. China supplied Iran with two "mini" research reactors installed at Isfahan. China also supplied Iran with a calutron, the type of equipment used in Iraq's electromagnetic isotope separation enrichment program for the separation of weapons-grade uranium. Both countries claim that the aid has been used exclusively for peaceful purposes, in line with Iran's NPT obligations.

In 1992, Washington persuaded Beijing to postpone indefinitely the sale to Iran of a plutonium-producing research reactor and also convinced Argentina not to export supporting fuel cycle and heavy-water production facilities.[33] In March 1992, China agreed to supply two 300-MW-electric nuclear power reactors to Iran. In the fall of 1995, however, China's reactor sale to Iran was suspended, ostensibly because of difficulties over site selection, although the underlying cause may have been Iran's difficulties in obtaining financing. Other factors may also have been involved. Some reports indicated that China suspended or even terminated the deal because of strong U.S. pressure.[34] In addition, France, Germany, and Japan apparently had declined to supply China with essential

components that it might have needed for the reactors it had offered Iran. It is also possible that Iran lost interest in the arrangement once it was confident that Russia would complete the Bushehr project.

In April 1996, the U.S. Department of Defense still regarded China as Iran's main source of nuclear assistance.[35] In the United States–China summit of October 1997, however, China made a commitment to cancel almost all its existing nuclear assistance to Iran and to provide Iran with no new nuclear assistance. By 2001, noting that "China appears to be living up to its 1997 commitments," the Department of Defense no longer viewed China as Iran's main nuclear source, although the United States continues to be concerned about some missile assistance from China to Iran.[36]

Russia

During early 1995, Russia proceeded with its contract to help Iran build a nuclear reactor at Bushehr. In March and April 1995, tensions rose with Russia when the Bill Clinton administration learned that, as part of a secret protocol to the reactor sale contract, Russia had agreed to provide Iran with a gas-centrifuge uranium enrichment facility. Such a facility, though itself under IAEA inspection and dedicated to the production of low-enriched (non-weapons-grade) uranium, could have enabled Iran to secretly build and operate a similar plant to produce weapons-grade uranium. Other disturbing elements of the protocol were an agreement in principle for Russia to supply a light-water research reactor of 30 to 50 MWt, 2,000 metric tons of natural uranium, and the training of Iranian graduates in nuclear sciences in Russia.[37]

Washington urged Moscow to halt its work on the Bushehr nuclear reactor but met with little success. U.S. concerns extended even beyond Bushehr, because Russian entities were known to also be cooperating with Iran on other projects as well.[38] Bushehr's benefits for Iran's nuclear weapons program are likely to be largely indirect. The project will augment Iran's nuclear technology infrastructure, helping Tehran's nuclear weapons research and development.[39] Iran could also benefit from the presence of the thousands of Russian nuclear scientists who are expected to take part in the Bushehr project.[40]

The United States

During the 1980s, the United States imposed a wide range of sanctions on Iran because of Tehran's support for international terrorism, its attacks in 1987 on U.S.-flagged Kuwaiti tankers, and other actions considered hostile to U.S. interests. Those sanctions blocked economic and military assistance to Iran, prohibited the importation of Iranian-origin goods, and restricted U.S. contributions to multilateral organizations that assist Iran and U.S. Export-Import Bank credits for Iran. U.S. efforts to curtail foreign nuclear sales to Iran intensified in the aftermath of the 1991 Gulf War.

The 1992 Iran-Iraq Arms Non-Proliferation Act expressly prohibited transfers of nuclear equipment and materials to Iran, as well as exports to Iran of all

dual-use commodities and U.S. government and commercial arms sales. The restriction applies both to nuclear dual-use commodities (that is, those having nuclear and non-nuclear uses and that are regulated internationally by the Nuclear Suppliers Group, or NSG) and to strategic dual-use commodities (that is, those having military and nonmilitary uses, which currently are regulated under the Wassenaar Arrangement).

In 1995 and 1996, the United States tightened sanctions on Iran, aiming in part to constrain Tehran's unconventional weapons programs.[41] Legislation adopted in February 1996 provided for U.S. economic assistance to Russia to be made contingent upon presidential determination that Russia had terminated its nuclear-related assistance to Iran.[42] The legislation permitted the president to waive this restriction at six-month intervals, however, upon a determination that making U.S. funds available to Russia was in the interest of U.S. national security. Such waivers have been regularly exercised.[43]

Washington further intensified economic pressure on Iran by imposing secondary sanctions on it and Libya, through the Iran and Libya Sanctions Act of 1996 (ILSA). The law imposes sanctions on foreign enterprises that invest $20 million or more in the energy sector of Iran. By the fall of 1997, this legislation faced a serious challenge from French, Malaysian, and Russian oil companies that had signed a deal with Iran to help recover and market oil and natural gas. The Clinton administration backed away from imposing the sanctions because of the economic crisis in East Asia and in Russia in the fall of 1997 and spring of 1998, which placed larger U.S. foreign policy interests at stake. The Bush administration has not been enthusiastic about ILSA, but in the summer of 2001 Congress extended ILSA for five years.

The United States has relied on the NSG to coordinate the Western embargo on nuclear sales to Iran and has persuaded some states to withhold goods that were regulated under the NSG's core export control guidelines. NSG rules permit the sale of such items, provided they are subject to IAEA inspection in the recipient state, but Washington has convinced its Western trading partners to adopt the stricter policy in the case of Iran.

In his first State of the Union address after the September 11, 2001, terrorist attacks, President George W. Bush declared Iran a member of an "axis of evil," pursuing nuclear, chemical, and biological weapons and exporting terror.[44] Since then, U.S. officials have repeatedly charged Iran with developing such weapons and called on the members of the IAEA Board of Governors to report Iran to the U.N. Security Council for violating its NPT obligations. The Bush administration has also insisted that Iran "abandon" its nuclear fuel cycle activities.[45] On November 17, 2004, then–U.S. secretary of state Colin Powell told reporters that Iran was working to adapt missiles to deliver a nuclear weapon, citing a classified intelligence report that Iran was working on mating warheads to missiles. The report, however, remains unverified.[46] Press reports revealed that the claim was based on a single, unvetted walk-in source who provided documents purported to be Iranian drawings and technical documents, including a nuclear warhead design.

Missile Analysis

Iran's acquisition of ballistic missiles began in the 1980s when, during the Iran-Iraq War, North Korea provided Iran with about 100 Scud-Bs and with facilities that enabled Iran to produce the Scuds indigenously.[47] During the early 1990s, Iran sought to acquire ballistic missile capabilities that could be used to deliver nuclear weapons. It turned to China, Libya, and North Korea for missile systems and related technologies. In the early 1990s, Iran reportedly discussed buying the 1,300-kilometer No Dong from North Korea.[48] On March 6, 1992, the United States imposed sanctions, under the missile nonproliferation provisions of the Arms Export Control and Export Administration Acts, against the Iranian Ministry of Defense and Armed Forces Logistics and against two North Korean entities for engaging in missile proliferation activities.

In June 1995, the press cited U.S. intelligence reports that "strongly implicate[d]" China in the transfer to Iran of equipment, materials, and scientific know-how that could be used in the manufacture of short-range ballistic missiles such as the Chinese M-9 and M-11.[49] China was believed to have transferred "dozens, perhaps hundreds, of missile guidance systems and computerized machine tools" to Iran, as well as rocket propellant ingredients that could be used in its current stockpile of short-range Scud–Mod Bs and Scud–Mod Cs, as well as on Scud variants that Iran might produce in the future.[50] In the final analysis, however, the United States did not find that China's missile transactions with Iran violated China's pledges related to the Missile Technology Control Regime, and thus it declined to impose regime-related sanctions against either China or Iran.[51]

In 2001, however, the U.S. Department of Defense still determined that Chinese, along with Russian, "entities have continued to supply a wide variety of missile-related goods, technology and expertise to Iran."[52] In 1996, it became clear that North Korea was exporting missile capabilities to Iran. As a result, on May 26, 1996, the United States imposed sanctions on the Iranian Ministry of Defense Armed Forces Logistics, the Iranian State Purchasing Office, and the Korea Mining Development Trading Bureau.[53] The precise nature of the offending transactions remains classified, but U.S. officials indicated that North Korea had sold missile components, equipment, and materials to Iran, although not complete missiles, production technology, or major subsystems.

During 1997, U.S. press reports quoted U.S. and Israeli intelligence findings that Russian enterprises—including cash-strapped Russian technical institutes, research facilities, and defense-production companies—were transferring Russian SS-4 medium-range ballistic missile technologies to Iran. According to these assessments, Iran hoped to employ these technologies to develop two Iranian derivatives of the 1,000-kilometer-range North Korean No Dong missile. In September 1997, then–U.S. vice president Al Gore raised the issue in Moscow with Prime Minister Viktor Chernomyrdin, as a result of which there was a visible decline in Russian assistance until the summer of 1998.[54]

Nevertheless, U.S. officials believe Russian assistance remains critical to Iran's development of the Shahab series, helping Iran to "save years in its development

of the Shahab III" and to "significantly accelerate the pace of its ballistic missile development program."[55] The Shahab III is projected to have a range of approximately 1,300 kilometers.

Iran has announced that the Shahab III is in production, as well as a new solid-propellant short-range ballistic missile, the Fateh-110, and it claims to have follow-on versions of the Shahab III in development.[56] The primary Iranian justification for the country's program is Israel's missile programs. Iranian defense minister Ali Shamkhani said in August 2004 that "the Israelis have recently tried to increase their missile capability and we will also try to upgrade our Shahab III missile in every respect."[57] An August 2004 test, for example, came just two weeks after Israel's Arrow antimissile system—designed to intercept Shahab missiles—shot down a test Scud missile for the first time.[58]

On November 5, 2003, the Iranian Defense Ministry stated that Iran did not have a program to build a Shahab IV missile. Outside experts had speculated that a Shahab IV, with an alleged 2,000-kilometer range and a 1,000-kilogram payload, could be based on the single-stage, liquid-fueled SS-4.[59] Iran is reportedly interested in two developmental North Korean intermediate-range ballistic missiles, the Taepo Dong I (TD-I) and Taepo Dong II (TD-II). These are both two-stage, liquid-fueled missiles, with theoretical ranges of 2,000 and 3,500 kilometers, respectively. A Shahab V missile program could be based on either of these missiles.[60] Yet none of these capabilities has actually surfaced, and they may simply be official aspirations or bravado.

The U.S. intelligence community has indicated that Iran will likely continue development of intermediate-range and even intercontinental ballistic missile (ICBM) systems by initially testing them as space launch vehicle (SLV) programs. The 2001 National Intelligence Estimate indicated uniform agreement among U.S. intelligence agencies that "Iran *could* attempt to launch an ICBM/SLV about mid-decade although most agencies believe Iran is *likely* to take until the last half of the decade to do so" (emphasis in original).[61] It was also noted that one agency does not find it likely that Iran will achieve a successful test of an ICBM before 2015. Since 1998, the National Intelligence Estimates have tended to overestimate the missile capabilities of developing nations. In his 2004 Worldwide Threat Assessment, Director of Central Intelligence George Tenet speculated that Iran "could begin flight testing [SLVs] in the mid- to latter-part of the decade."[62]

Biological and Chemical Weapons Analysis

Despite Iran's ratification of the Biological Weapons Convention in 1973, U.S. officials believe that Iran has pursued biological weapons under the guise of its extensive biotechnology and pharmaceutical industries. In 2001, at the Fifth Review Conference of the Biological Weapons Convention, the U.S. undersecretary of state for arms control and international security at that time, John Bolton, said that Iran had "probably" produced and weaponized BW agents.[63] In 2004, his assessment was more cautious: "Because BW programs are easily concealed, I cannot say that the United States can prove beyond a shadow

of a doubt that Iran has an offensive BW program. The intelligence I have seen suggests that this is the case."[64]

In May 2003, on the basis of intelligence from the exiled National Council of Resistance of Iran (NCR), the *Washington Post* reported that Iran had begun producing biological weapons, including anthrax. Citing informants within the Iranian government, the NCR reported that the anthrax weapons were part of a program begun in 2001 intended to triple Iran's biowarfare program. Other pathogens being weaponized, the NCR said, included alfatoxin, typhus, smallpox, plague, and cholera. The group could not produce any evidence to support its claims.[65]

The United States believes that Iran also continues a chemical weapons program that seeks production technology, training, and expertise to achieve an indigenous capability to produce nerve agents.[66] Iran began its chemical weapons program to deter Iraq's use of chemical weapons during the Iran-Iraq War. During that war, Iraq employed chemical weapons, primarily mustard gas and the nerve agent tabun, against Iranian troops, with approximately 50,000 casualties reported.[67]Allegedly, Iran also employed chemical weapons late in the war, but with less success than Iraq. Iran ratified the Chemical Weapons Convention in 1997, but the CIA reports that Iran has continued to seek technology, training, and expertise from Chinese entities.[68]

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Table 15.1. **Iran's Nuclear Infrastructure**

Name/Location of Facility	Type/Status	IAEA Safeguards
Power Reactors		
Bushehr I	Light-water, LEU, 1,000 MWe, damaged by Iraqi air strikes (1987, 1988), construction completed October 2004, scheduled to be launched 2005 and reach full capacity by 2006	Yes
Bushehr II	Light-water, LEU, 1,300 MWe, damaged by Iraqi air strikes (1987, 1988), facility remains unfinished, and project is currently suspended	No
Research Reactors		
Tehran Research Reactor/ IR-0001	Light-water, HEU, 5 MWt, pool type, operating	Yes
IR-0005/MNSR Isfahan	Miniature neutron source reactor (MNSR), 900 grams of HEU fuel, 27 kWt, operating	Yes
ENTC GSCR Isfahan	Graphite-moderate subcritical assembly, Chinese-built, went critical in 1992, LEU, operating	Yes
ENTC LWSCR Isfahan	Light-water, zero-power, open tank facility fueled by uranium metal pins, Chinese-built, went critical in 1992, LEU, operating	Yes
IR-0004/ HWZPR Isfahan	Heavy-water, zero-power reactor (HWZPR), 10 kWt, LEU, operating	Yes
Uranium Encirhment		
Pilot Fuel Enrichment Plant (PFEP) Natanz	Capacity of 1,000 P-1 centrifuges, began testing a ten-machine cascade in August 2003, construction/operation suspended	Yes
Fuel Enrichment Plant (FEP) Natanz	Commercial plant, 50,000-centrifuges capacity, originally scheduled to start accepting centrifuges in 2005, construction/operation suspended	Yes
Kalaye Electric Company	Centrifuge tests using UF_6 conducted between 1998 and 2003	Yes

(table continues on the following page)

Table 15.1. **Iran's Nuclear Infrastructure** (continued)

Name/Location of Facility	Type/Status	IAEA Safeguards
Lashkar Ab'ad	Pilot laser enrichment plant established in 2000, laser enrichment experiments conducted between October 2002 and January 2003, plant dismantled in 2003	Yes
Reprocessing (Plutonium Extraction)		
Tehran Nuclear Research Center	Irradiated depleted UO_2 targets at the Tehran Research Reactor between 1988 and 1998. Also 3 kilograms of UO_2 reprocessed in three shielded boxes in a hot cell to produce at least 200 micrograms of plutonium, shielded boxes dismantled in 1992.[1]	Yes
Uranium Processing		
Isfahan Conversion Facility	Converts uranium yellowcake into UF_4 and UF_6, became operational in February 2004, operation suspended	Yes
Esfahan Fuel Manufacturing Plant	Scheduled to be commissioned 2007, capacity of 40 tons per year of UO_2 fuel	Yes
Jabr Ibn Hayan Lab—Tehran Nuclear Research Center	UF_4 converted into uranium metal, storage of UF_6, UF_4, and UO_2 from China, also storage of plutonium separated from depleted uranium at Tehran Nuclear Research Center	Yes
Saghand Yazd Province	Discovery of uranium deposits announced in 1990, 5,000 tons of uranium reserves.	No
Plutonium Production		
Arak Heavy Water Reactor (IR-40)	40 MWt heavy-water reactor, nat. U oxide as fuel, construction scheduled to begin in 2004 and reactor to go into operation in 2014, planned	Yes
Heavy-Water Production[2]		
Khondab, near Arak	Heavy-water production plant, production capacity 100 tons per year, scheduled to start producing heavy water in 2004, under construction	No

Storage		
Karaj	Equipment from Pilot Laser Enrichment plant at Lashkar Ab'ad, dismantled in May 2003, stored	Yes

Abbreviations

HEU	highly enriched uranium
LEU	low-enriched uranium
nat. U	natural uranium
MWe	megawatts electric
MWt	megawatts thermal
kWt	kilowatts thermal

Sources

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Notes

1. Iran claims that it produced 200 micrograms of plutonium in these experiments, but the IAEA estimates that more plutonium should have been produced. IAEA is investigating this discrepancy.
2. The nonproliferation regime does not include the application of safeguards to heavy-water production facilities, but safeguards are required on the export of heavy water.